PUBLIC HEALTH

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SUMMARY OF CONCLUSIONS

The California Energy Commission staff analyzed the potential human health risks associated with construction and operation of the proposed Hidden Hills Solar Electric Generating System (HHSEGS) project and does not expect any significant adverse cancer, short- or long-term noncancer health effects from the project's toxic emissions. Staff's analysis of potential health and safety impacts uses a highly conservative methodology that accounts for impacts on the most sensitive individuals in a given population, including newborns and infants. According to staff's assessment, emissions from the HHSEGS would not contribute significantly to morbidity or mortality in any age or ethnic group residing in the project area.

The public health impacts from the line segments (transmission line and natural gas line portions) within the state of Nevada would be assessed by BLM under the requirements of the National Environmental Policy Act (NEPA) of 1969 (HHSG 2011a, pp. 3-2 and 3-3).

INTRODUCTION

The purpose of this Final Staff Assessment (FSA) is to determine if emissions of toxic air contaminants (TACs) from the proposed HHSEGS would have the potential to cause significant adverse public health impacts or to violate standards for public health protection. If potentially significant health and safety impacts are identified, staff would identify and recommend mitigation measures necessary to reduce such impacts to insignificant levels.

The Commission staff address the potential impacts of regulated, or criteria, air pollutants in the **Air Quality** section of this FSA, and assess the impacts on public and worker health from accidental releases of hazardous materials in the **Hazardous Materials Management** and **Worker Safety and Fire Protection** sections. The health and nuisance effects from electric and magnetic fields are discussed in the **Transmission Line Safety and Nuisance** section. Pollutants released from the project's wastewater streams are discussed in the **Soils and Surface Water** and **Water Supply** sections. Releases in the form of hazardous and nonhazardous wastes are described in the **Waste Management** section.

LAWS, ORDINANCES, REGULATIONS, AND STANDARDS (LORS)

The federal, state, and local laws and policies applicable to the control of TAC emissions and mitigation of public health impacts for the HHSEGS are summarized in **Public Health Table 1**. Staff's analysis examines the project's compliance with these requirements and summarizes the applicable LORS.

Public Health Table 1
Laws, Ordinances, Regulations, and Standards (LORS)

Applicable Law	Description
Federal	
Clean Air Act section 112 (Title 42, U.S. Code section 7412)	Section 112 of the Clean Air Act addresses emissions of hazardous air pollutants (HAPs). This act requires new sources that emit more than 10 tons per year of any specified HAP or more than 25 tons per year of any combination of HAPs to apply Maximum Achievable Control Technology (MACT).
40 Code of Federal Regulations (CFR) Part 68 (Risk Management Plan)	Requires facilities storing or handling significant amounts of acutely hazardous materials to prepare and submit Risk Management Plans.
State	
California Health and Safety Code section 25249.5 et seq. (Safe Drinking Water and Toxic Enforcement Act of 1986—Proposition 65)	These sections establish thresholds of exposure to carcinogenic substances above which Prop 65 exposure warnings are required.
California Health and Safety Code, Article 2, Chapter 6.95, Sections 25531 to 25541; California Code of Regulations (CCR) Title 19 (Public Safety), Division 2 (Office of Emergency Services), Chapter 4.5 (California Accidental Release Prevention Program)	Requires facilities storing or handling significant amounts of acutely hazardous materials to prepare and submit Risk Management Plans
California Health and Safety Code section 41700	This section states that "a person shall not discharge from any source whatsoever such quantities of air contaminants or other material which cause injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public, or that endanger the comfort, repose, health, or safety of any such persons or the public, or which cause, or have a natural tendency to cause injury or damage to business or property."
California Health and Safety Code Sections 44360 to 44366 (Air Toxics "Hot Spots" Information and Assessment Act—AB 2588)	Requires preparation and biennial updating of facility emission inventory of hazardous substances; risk assessments.
California Public Resource Code section 25523(a); Title 20 California Code of Regulations (CCR) section 1752.5, 2300–2309 and	These regulations require a quantitative health risk assessment for new or modified sources, including power plants that emit one or more toxic air contaminants (TACs).

Applicable Law	Description
Division 2 Chapter 5, Article 1, Appendix B, Part (1); California Clean Air Act, Health and Safety Code section 39650, et seq.	
Local	
The Great Basin Unified Air Pollution Control District (GBUAPCD) Rule 220, Construction or Reconstruction of Major Sources of Hazardous Air Pollutants	Requires the evaluation of the potential impact of TACs from new or modified projects.
The Great Basin Unified Air Pollution Control District (GBUAPCD) Rule 401, Fugitive Dust	This rule is intended to minimize the formation and transport of fugitive dust from anthropogenic activity.

SETTING

This section describes the environment in the vicinity of the proposed project site from the public health perspective. Characteristics of the natural environment, such as meteorology and terrain, affect the project's potential for impacts on public health. An emissions plume from a facility may affect elevated areas before lower terrain areas because of reduced opportunity for atmospheric mixing. Consequently, areas of elevated terrain can often be subjected to increased pollutant impacts compared to lower-level areas. Also, the land use around a project site can influence the surrounding population in terms of distribution and density, which, in turn, can affect public exposure to project emissions. Additional factors affecting potential public health impacts include existing air quality and environmental site contamination. The area around the proposed HHSEGS is rural and sparsely populated, and is primarily zoned as open space (HHSG 2011a, section 1.9.3).

SITE AND VICINITY DESCRIPTION

The proposed HHSEGS site is located on privately owned land in southeastern Inyo County and is directly adjacent to the California-Nevada border, within the Great Basin Valleys Air Basin (GBVAB) and within the Great Basin Unified Air Pollution Control District (GBUAPCD). The two counties of Nevada adjacent to Inyo County are Nye County and Clark County.

The HHSEGS would have two solar fields and associated facilities (Solar Plant 1 and Solar Plant 2). Each solar plant would generate 270 megawatts (MW) of gross energy (or 250 MW of net energy), for a total net output of 500 MW. Each solar plant would include a 750-ft-tall solar power tower and two natural-gas-fired boilers: one auxiliary boiler and one night preservation boiler. The auxiliary boiler would be used to pre-warm the solar receiver steam generator (SRSG) to minimize the amount of time required for startup each morning, to assist during shutdown cooling operation, and to augment the solar

operation when solar energy diminishes under cloudy conditions. The nighttime preservation boiler would be used to maintain minimum system temperatures overnight. The natural gas pipeline proposed for this project would be approximately 12 inches in diameter, and approximately 32.4 miles in total length (HHSG 2011a, section 2.0, CH2 2012ee, p.1).

According to the Application for Certification (AFC), there are no sensitive receptor locations such as daycare centers, hospitals, parks, schools or preschools within 6 miles of the project site (HHSG 2011a section 5.9.3). The St. Therese Mission (a commercial facility) is under construction at a location approximately 0.5 mile southeast of the HHSEGS. The facility is considered a sensitive receptor location because it would include a children's playground and a residential unit.

The nearest residence to any of the power blocks is approximately 3,500 feet south of the Solar Plant 2 power block and about 950 feet south of the project's southern boundary. The closet community to the project site is several dozen residences that comprise Charleston View, south of Tecopa Road (also known as Old Spanish Trail Highway). The closest town to the project is Pahrump, Nevada, located approximately 8 miles directly north of the project area, with a 2010 projected population of 36,441 (HHSG 2011a section 5.6.3.1 and section 5.9.3).

METEOROLOGY AND CLIMATE

Meteorological conditions, including wind speed, wind direction, and atmospheric stability, affect the extent to which pollutants are dispersed into the air as well as the direction of pollutant transport. This, in turn, affects the level of public exposure to emitted pollutants along with the associated health risks. When wind speeds are low and the atmosphere is stable, for example, dispersion is reduced, and localized exposures may increase.

Atmospheric stability is one characteristic related to turbulence, or the ability of the atmosphere to disperse pollutants from convective air movement. Mixing heights (the height marking the extent of the space within which the air is well mixed and from which pollutants can be dispersed to other areas) are lower during mornings because of temperature inversions and increase during the warmer afternoons. Staff's **Air Quality** section presents a more detailed description of meteorological data for the area.

Southeastern Inyo County is characterized by a desert climate: low precipitation, hot summers, and cold winters. The mountain ranges surrounding the project area also have a major influence on the climate as they serve as a meteorological boundary that effectively removes the moisture from the air moving into the area. (HHSG 2011a, section 5.1.3.2)

The wind roses provided in the AFC Figures 5.1-1 thru 5.1-5 (HHSEGS 2011a) show that for most of the year, prevailing winds blow from the proposed project site into Nevada. Approximately 26 percent of prevailing winds are from Nevada. This means that the project area is not significantly impacted by emissions from Nevada. Please refer to the **Air Quality** section of this **FSA** for more details.

EXISTING SETTING

As previously noted, the proposed HHSEGS site is located within the Great Basin Valleys Air Basin (GBVAB) and within the Great Basin Unified Air Pollution Control District (GBUAPCD). By examining average toxic concentration levels from representative air monitoring sites together with the cancer risk factors specific to each carcinogenic contaminant, a lifetime cancer risk can be calculated to provide a background risk level for inhalation of ambient air. When examining such risk estimates, staff considers it important to note that the overall lifetime risk of developing cancer for the average female in the United States is about 1 in 3, or 333,333 in 1 million and about 1 in 2, or 500,000 in 1 million for the average male (American Cancer Society, 2011). From 2004 to 2008, the cancer incidence rates in California are 51.28 in 1 million for males and 39.69 for females. Meanwhile, the cancer incidence rates in Nevada are 50.76 in 1 million for males and 40.41 for females. Also, from 2004 to 2008, the cancer death rates for California are 19.74 in 1 million for males and 14.34 for females. Meanwhile, the cancer death rates in Nevada are 21.47 in 1 million for males and 16.3 for females (American Cancer Society, 2012).

EXISTING PUBLIC HEALTH CONCERNS

When evaluating a new project, staff usually conducts a detailed study and analysis of existing public health issues in the project vicinity. This analysis is prepared to identify the current rates of respiratory diseases (including asthma) and cancer, together with childhood mortality rates in the area around the proposed project site. Such assessment of existing health concerns would provide staff with a basis on which to evaluate the significance of any additional health impacts from the proposed HHSEGS project and assess the need for further mitigation.

The applicant has listed a few studies of cancer and respiratory disease rates in Inyo County and the broader Great Basin Valleys Air Basin (GBVAB). One fact that staff considers particularly important is that asthma diagnosis rates in the GBVAB area are higher than the average rates in California for both adults (age 18 and over) and children (ages 1-17). The percentage of adults diagnosed with asthma was, for example, reported as 9.3 percent in 2005 and 2007, compared to 7.7 percent for the general California population. Rates for children for the same 2005-2007 period were reported as 13.2 percent compared to 10.1 percent for the state in general (Wolstein et al., 2010). The authors did not identify any specific reasons for these higher rates of asthma in Inyo County but staff considers these findings as further support for continuing stringency in controlling the sources of pollutants in the area.

By examining the State Cancer Profiles as presented by the National Cancer Institute, staff found that cancer death rates in Inyo County have remained stable between 2005 and 2009. However, these rates (of 19.06 per 1,000,000, combined male/female) remain about 17 percent higher in Inyo County than the statewide average of 16.31 per 1,000,000 (National Cancer Institute, 2012). As with asthma, there are no specific reasons for these higher cancer rates pointing to the necessity for stringent pollution controls within the air district.

There are no ambient monitoring stations for Toxic Air Contaminants (TACs) in the

GBVAB. Therefore, staff used data from the San Joaquin Valley Air Basin (SJVAB) as the closest representation of the condition in the project area. Air quality and health risk data presented by ARB in Table C-34 of California Almanac of Emissions and Air Quality – 2009 Edition (ARB, 2009a) for the SJVAB for years 1990 and 2005 show a downward trend in Toxic Air Contaminant (TAC) emissions, along with related cancer risks (HHSG 2011a, section 5.9.3).

ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

METHOD AND THRESHOLD FOR DETERMINING SIGNIFICANCE

This section discusses TAC emissions to which the public could be exposed during project construction and routine operation. Following the release of TACs into the air, water or soil, people may come into contact with them through inhalation, dermal contact, or ingestion via contaminated food or water.

Air pollutants for which no ambient air quality standards have been established are called non-criteria pollutants. Unlike criteria pollutants such as ozone, carbon monoxide, sulfur dioxide, or nitrogen dioxide, non-criteria pollutants have no ambient (outdoor) air quality standards that specify levels considered safe for everyone[1]. Since non-criteria pollutants do not have such standards, a health risk assessment (HRA) is used to determine if people might be exposed to those types of pollutants at unhealthy levels. The risk assessment consists of the following steps:

- identify the types and amounts of hazardous substances that HHSEGS could emit to the environment;
- estimate worst-case concentrations of project emissions in the environment using dispersion modeling;
- estimate amounts of pollutants that people could be exposed to through inhalation, ingestion, and dermal contact; and
- characterize potential health risks by comparing worst-case exposure to safe standards based on known health effects.

Staff conducts its public health analysis by evaluating and then adopting the information and data provided in AFC by each project proponent. Staff also relies upon the expertise and guidelines of the California Environmental Protection Agency (Cal/EPA) Office of Environmental Health Hazard Assessment (OEHHA) to identify contaminants known to the state of California to cause cancer or other noncancer health effects and to also identify the toxicity and cancer potency factors of these contaminants. Staff relies upon the expertise of the California Air Resources Board (ARB) and in addition, the local air districts to conduct ambient air monitoring of TACs and on the California Department of Public Health to evaluate pollutant impacts in specific communities. It is not within the purview or the expertise of the Energy Commission staff to duplicate the expertise and statutory responsibility of these agencies.

[1] Carbon dioxide (CO_2) is also a non-criteria pollutant, but it is also not considered a TAC at normal consideration and is not evaluated in this analysis.

For each project, a screening-level risk assessment is initially performed using simplified assumptions that are intentionally biased toward protection of public health. That is, staff uses an analysis designed to overestimate public health impacts from exposure to project emissions. In reality, it is likely that the actual risks from the source in question would be much lower than the risks as estimated by the screening-level assessment. The risks for such screening purposes are based on examining conditions that would lead to the highest, or worst-case, risks and then using those assumptions in the assessment. Such an approach usually involves the following:

- using the highest levels of pollutants that could be emitted from the plant;
- assuming weather conditions that would lead to the maximum ambient concentration of pollutants;
- using the type of air quality computer model which predicts the greatest plausible impacts;
- calculating health risks at the location where the pollutant concentrations are estimated to be the highest;
- assuming that an individual's exposure to carcinogenic (cancer-causing) agents would occur continuously for 70 years; and
- using health-based standards designed to protect the most sensitive members of the population (i.e., the young, elderly, and those with respiratory illnesses).

A screening-level risk assessment would, at a minimum, include the potential health effects from inhaling hazardous substances. Some facilities may also emit certain substances that could present a health hazard from noninhalation pathways of exposure (OEHHA 2003, Tables 5.1, 6.3, 7.1). When these substances are present in facility emissions, the screening-level analysis would include the following additional exposure pathways: soil ingestion, dermal exposure, and mother's milk (OEHHA 2003, p. 5-3).

The risk assessment process addresses three categories of health impacts: (1) acute (short-term) health effects, (2) chronic (long-term) noncancer effects, and (3) cancer risk (also long-term).

Acute Noncancer Health Effects

Acute health effects are those that result from short-term (one-hour) exposure to relatively high concentrations of pollutants. Such effects are temporary in nature and include symptoms such as irritation of the eyes, skin, and respiratory tract.

Chronic Noncancer Health Effects

Chronic noncancer health effects are those that result from long-term exposure to lower concentrations of pollutants. The exposure period is considered to be approximately from 12 percent to 100 percent of a lifetime, or from 8 to 70 years (OEHHA 2003, p. 6-5). Chronic noncancer health effects include diseases such as reduced lung function and heart disease.

Reference Exposure Levels (RELs)

The analysis for both acute and chronic noncancer health effects compares the maximum project contaminant levels to safe levels known as Reference Exposure Levels, or RELs. These are amounts of toxic substances to which even sensitive individuals could be exposed without suffering any adverse health effects (OEHHA 2003, p. 6-2). These exposure levels are specifically designed to protect the most sensitive individuals in the population, such as infants, the aged, and people with specific illnesses or diseases which makes them more sensitive to the effects of toxic substance exposure. The RELs are based on the most sensitive adverse health effect reported in the medical and toxicological literature and include specific margins of safety. The margins of safety account for uncertainties associated with inconclusive scientific and technical information available at the time of standard setting. They are therefore meant to provide a reasonable degree of protection against hazards that research has not yet identified.

Concurrent exposure to multiple toxic substances may result in health effects that are equal to, less than, or greater than effects resulting from exposure to the individual chemicals. Only a small fraction of the thousands of potential combinations of chemicals have been tested for the health effects of combined exposures. In conformity with the California Air Pollution Control Officers Association (CAPCOA) guidelines, the health risk assessment assumes that the effects of each substance are additive for a given organ system (OEHHA 2003, pp. 1-5, 8-12). Other possible mechanisms due to multiple exposures include those cases where the actions may be synergistic or antagonistic (where the effects are greater or less than the sum, respectively). For these types of exposures, the health risk assessment could underestimate or overestimate the risks.

Cancer Risk and Estimation Process

For carcinogenic substances, the health assessment considers the risk of developing cancer and assumes that continuous exposure to the carcinogen would occur over a 70-year lifetime. The risk that is calculated is not meant to project the actual expected incidence of cancer, but rather a theoretical upper-bound estimate based on the worst-case assumptions.

Cancer risk is expressed in terms of chances per million of developing cancer and is a function of the maximum expected pollutant concentration, the probability that a particular pollutant would cause cancer (called potency factors and established by OEHHA), and the length of the exposure period. Cancer risks for individual carcinogens are added together to yield a total cancer risk for each potential source. The conservative nature of the screening assumptions used means that the actual cancer risks from project emissions would be considerably lower than estimated.
As previously noted, the screening analysis is performed to assess the worst-case risks to public health associated with the proposed project. If the screening analysis were to predict a risk below significance levels, no further analysis would be necessary and the source would be considered acceptable with regard to carcinogenic effects. If however, the risk were to be above the significance level, then further analysis, using more realistic site-specific assumptions, would be performed to obtain a more accurate estimate.

Significance Criteria

Energy Commission staff assesses the maximum cancer impacts from specific carcinogenic exposures by first estimating the potential impacts on the maximum exposed individual. This is a person hypothetically exposed to project emissions at a location where the highest ambient impacts were calculated using the worst-case assumptions as described above. Since the individual's exposure would produce the maximum impacts possible around the source, staff uses this risk estimate as a marker for acceptability of the project's carcinogenic impacts.

Acute and Chronic Noncancer Health Risks

As described earlier, non-criteria pollutants are evaluated for short-term (acute) and long-term (chronic) non-cancer health effects, as well as the noted cancer impacts from usually long-term exposures. The significance of project-related impacts is determined separately for each of the three health effects categories. Staff assesses the noncancer health effects by calculating a hazard index. A hazard index is a ratio obtained by comparing exposure from facility emissions to the safe exposure level (i.e. Reference Exposure Level, or REL) for that pollutant. A ratio of less than 1.0 suggests that the worst-case exposure would be below the limit for safe levels and would thus be insignificant with regarding to health effects. The hazard indices for all toxic substances with the same type of health effect are added together to yield a Total Hazard Index for the source. The Total Hazard Index is calculated separately for acute effects and chronic effects. A Total Hazard Index of less than 1.0 would indicate that cumulative worst-case exposures would not lead to significant noncancer health effects. In such cases, noncancer health impacts from project emissions would be considered unlikely even for sensitive members of the population. Staff would therefore presume that there would be no significant noncancer project-related public health impacts. This assessment approach is consistent with those in the risk management guidelines of both California OEHHA and U.S. EPA.

Cancer Risk

Staff relies upon regulations implementing the provisions of Proposition 65, the Safe Drinking Water and Toxic Enforcement Act of 1986, (Health & Safety Code, §§25249.5 et seq.) for guidance in establishing its significance levels for carcinogenic exposures. Title 22, California Code of Regulations section 12703(b) states that "the risk level which represents no significant risk shall be one which is calculated to result in one or less excess cancer cases within an exposed population of 100,000, assuming lifetime exposure." This risk level is equivalent to a cancer risk of 10 in 1 million, which is also written as 10×10^{-6}. In other words, under state regulations, an incremental cancer risk of greater than 10 in 1 million from a project should be regarded as suggesting a potentially significant carcinogenic impact on public health. The 10 in 1 million risk level is also used by the Air Toxics "Hot Spots" (AB 2588) program as the public notification threshold for air toxic emissions from existing sources.

An important distinction between staff's and the Proposition 65 risk characterization approach is that the Proposition 65 significance level applies separately to each cancer-causing substance, whereas staff determines significance based on the total risk from all the cancer-causing pollutants to which the individual might be exposed in the given case. Thus, the manner in which the significance level concept is applied by staff is

more conservative (health-protective) than that applied by Proposition 65. The significant risk level of 10 in 1 million is also consistent with the level of significance adopted by many California air districts. In general, these air districts would not approve a project with a cancer risk estimate of more than 10 in 1 million.

As described above, the initial risk analysis for a project is typically performed at a screening level, which is designed to overstate actual risks, so that health protection could be ensured. Staff's analysis also addresses potential impacts on all segments of the population including the young, the elderly, people with existing medical conditions that may render them more sensitive to the adverse effects of toxic air contaminants, and any minority or low-income populations that are likely to be disproportionately affected by impacts. To accomplish this goal, staff uses the most current acceptable public health exposure levels (both acute and chronic) set to protect the public from the effects of air toxics in question. When a screening analysis shows the cancer risks to be above the significance level, refined assumptions would be applied for likely a lower, more realistic risk estimate. If after refined assumptions, the project's risk is still found to exceed the significance level of 10 in 1 million, staff would require appropriate measures to reduce the risk to less than significant levels. If, after all risk reduction measures have been considered, a refined analysis still identifies a cancer risk of greater than 10 in 1 million, staff would deem such a risk to be significant and would not recommend project approval.

DIRECT /INDIRECT IMPACTS AND MITIGATION

Proposed Project's Construction Impacts and Mitigation Measures

Construction of HHSEGS is expected to take place from the second quarter of 2013 to the fourth quarter of 2016 (a total of 29 months). Construction of the commonly shared facilities would occur concurrently with the construction of Solar Plant 1. Solar Plant 2 construction would occur about 3 months behind that of Solar Plant 1. The applicant conducted the Construction Emissions and Impact Analysis for this site and concluded that "no significant public health effects would be expected during construction." (HHSG 2011a, Appendix 5.1F) Staff concurs with the applicant based upon staff's evaluation of the mitigation measures specified by the applicant as necessary to minimize such impacts. Such potential construction risks are normally associated with exposure to fugitive dust and combustion emissions. Fugitive dust emissions could occur from:

- Dust entrained during site preparation and grading/excavation/trenching at the construction site;
- Dust entrained during onsite movement of construction vehicles on unpaved surfaces;
- Fugitive dust emitted from an onsite concrete batch plant; and
- Wind erosion of areas disturbed during construction activities.

Combustion emissions during construction would result from:

- Exhaust from the diesel construction equipment used for site preparation, grading, excavation, trenching, and construction of onsite and offsite (transmission- and gas pipeline-related) structures;

- Exhaust from water trucks used to control construction dust emissions;
- Exhaust from portable welding machines, small generators, and compressors;
- Exhaust from pickup trucks and diesel trucks used to transport workers and materials around the construction areas;
- Exhaust from diesel trucks used to deliver concrete, fuel, and construction supplies to the construction areas; and
- Exhaust from automobiles used by workers to commute to and from the construction areas.

Diesel Exhaust

The operation of construction equipment would result in air emissions from diesel-fueled construction equipment. Diesel exhaust is a complex mixture of thousands of gases and fine particles and contains over 40 substances listed by the U.S. Environmental Protection Agency (U.S. EPA) as hazardous air pollutants (HAPs) and by the California Air Resources Board (ARB) as toxic air contaminants (TACs). The diesel particulate matter (DPM) is primarily composed of aggregates of spherical carbon particles coated with organic and inorganic substances. Diesel exhaust deserves particular attention mainly because of its ability to induce serious noncancer effects and its status as a likely human carcinogen. The DPM emissions from on-site HHSEGS construction activities are summarized in **Public Health Table 2**.

Public Health Table 2
Maximum Onsite DPM Emissions during Construction

Emitting Activity	Pounds per Day	Tons per Year
Construction Equipment	4.4	0.1

Source: HHSG 2011a, Table 5.9-3.

Diesel exhaust is characterized by ARB as “Particulate Matter from Diesel-Fueled Engines”. The impacts from human exposure may include both short- and long-term health effects. Short-term effects can include increased coughing, labored breathing, chest tightness, wheezing, and eye and nasal irritation. Effects from long-term exposure can include increased coughing, chronic bronchitis, reductions in lung function, and inflammation of the lung. Epidemiological studies strongly suggest a causal relationship between occupational diesel exhaust exposure and lung cancer. Diesel exhaust is listed by the EPA as “likely to be carcinogenic to humans.” (US. EPA, 2003)

Based on a number of health effects studies, the Scientific Review Panel (SRP) on Toxic Air Contaminants in 1998 recommended a chronic REL for diesel exhaust particulate matter of 5 micrograms of diesel particulate matter per cubic meter of air (µg/m3) and a cancer unit risk factor of $3x10^{-4}$ $(µg/m3)^{-1}$. The Scientific Review Panel did not recommend a specific value for an acute REL since available data in support of a value was deemed insufficient. On August 27, 1998, ARB listed particulate emissions from diesel-fueled engines as a toxic air contaminant and approved the panel’s recommendations regarding health effects. (OEHHA 2009, Appendix A)

The applicant conducted a health risk assessment for diesel exhaust from construction activities and the results are listed in **Public Health Table 3**. The assessment used the Hot Spots Reporting Program (HARP) - derived risk values for diesel particulate matter together with a nine-year exposure period to calculate this construction-related cancer risk. This approach is as specified in the OEHHA guidelines (OEHHA, 2003). The maximum modeled annual average concentration of diesel particulate matter at any location was calculated to be 0.139 $\mu g/m^3$. The cancer unit risk value from HARP for an assumed 9-year exposure is $5.33x10^{-5}$ per $\mu g/m^3$, which is lower than the cancer unit risk of $3x10^{-4}$ $(\mu g/m^3)^{-1}$ from SRP/ARB since the one from SRP/ARB is derived for longer-term exposures. The calculated cancer risk is approximately 7.41 in one million[2] which is below the significance level of 10 in one million. As described above, construction of the two power plants of HHSEGS is anticipated to take place over a period of 29 months, which is shorter than 9 years assumed in the applicant's calculations. Therefore, the applicant's analysis should be regarded as conservative because of the inherently conservative exposure-related assumptions made in the modeling analysis. (HHSG 2011a Appendix 5.1F) Staff regards the related conditions of certification in the **Air Quality** section as adequate to ensure that the applicant follows the strict construction practices recognized by the industry and regulatory agencies as effective mitigation against construction emissions in general.

The chronic hazard index for diesel exhaust during construction activities is 0.028 as calculated by staff using a chronic noncancer REL of 5 $\mu g/m^3$. This index is lower than the significance level of 1.0 meaning that there would be no chronic noncancer impacts from construction activities. The potential levels of criteria pollutants from operation of construction-related equipment are discussed in staff's **Air Quality** section along with mitigation measures and related conditions of certification. The pollutants of most concern in this regard are PM10, carbon monoxide (CO), sulfur dioxide (SO_2), and nitrogen dioxide (NO_2).

Public Health Table 3
Construction Hazard/Risk from DPMs

Cancer Unit Risk Used $(\mu g/m^3)^{-1}$	**Cancer Risk (in one million)**	**Significance Level**	**Significant?**
$5.33x10^{-5}$ [a]	7.41	10	No
Chronic Noncancer REL $(\mu g/m^3)$	**Hazard Index (HI)**		
5 [b]	0.028	1	No

[a] Obtained by the applicant from HARP for a 9-year exposure period (the derived adjusted method). Source: Applicant.
[b] Source: OEHHA and ARB.

[2] The risk of 7.41 in one million was calculated using the following formula:
Cancer Risk = Concentration of Diesel Exhaust × Cancer Unit Risk = 0.139 $\mu g/m^3$ × $5.33x10^{-5}$ per $\mu g/m^3$ = $7.41x10^{-6}$

HHSEGS is proposed for an area where the disease of Valley Fever[3] (*Coccidioidomycosis)* may sometimes be present. Construction could disturb a certain percentage of approximately 3,277 acres[4] of top soil that could harbor the *Coccidioides* spores possibly exposing humans to the risk of Valley Fever. On-site workers and visitors could be exposed from inhaling these fungal spores from wind-blown dust generated from soil excavation work. To minimize the risk of getting Valley Fever, Center for Disease Control and Prevention (CDC) recommends the following measures:

- Wear an N95 mask if a person must be in or near a dusty environment, such as a construction zone
- Avoid activities that involve close contact to dust including yard work, gardening, and digging
- Use air quality improvement measures indoors such as HEPA filters
- Take prophylactic anti-fungal medication if deemed necessary by a person's healthcare provider
- Clean skin injuries well with soap and water, especially if they have been exposed to soil or dust

The California Department of Public Health (CDPH) also recommends that "those exposed to dust during their jobs or outside activities in these areas should consider respiratory protection, such as a mask, during such activities." (California Department of Public Health)

Based on CDC and CDPH's recommendations, staff recommends that workers in the vicinity of such dust generation areas wet the soil before any excavation activities, wear protective masks and stay indoors during dust storms and close all doors to avoid dust inhalation. Staff also considers the applicant's dust suppression plans adequate to minimize the risk of getting Valley Fever in areas where *Coccidioides* spores are found. Please also refer to staff's **Worker Safety and Fire Protection** section for more information.

As for the concerns of Valley Fever on public health, in the **Air Quality Section** of this FSA, staff recommends some mitigation measures, including **AQ-SC3 (Construction Fugitive Dust Control)**, **AQ-SC4 (Dust Plume Response Requirement)** and **AQ-SC7 (Site Operation Dust Control Plan)** for the purposes of preventing all fugitive dust plumes from leaving the project boundary. As long as the dust plumes are kept within the project boundary, there won't be any significant concern for Valley Fever adversely affecting public health.

Small quantities of hazardous wastes may be generated during construction of the project. The applicant stated that "hazardous waste management plans will be in place so the potential for public exposure is minimal". Please, refer to staff's **Waste**

[3] Valley fever is an infection that occurs when the spores of the fungus *Coccidioides immitis* enter human's lung through inhalation. When people breathe in these *Coccidioides* spores, they are at risk of developing Valley Fever.

[4] 1,483 acres in Solar Plant 1, 1,510 acres in Solar Plant 2, 103 acres in common area, and 180 acres in the temporary construction area (HHSG 2011a, § 5.6.1).

Management section of this **FSA** for more information on the safe handling and disposal of these and all project-related wastes.

Proposed Project's Operational Impacts and Mitigation Measures

Emission Sources

As previously noted, the proposed HHSEGS facility would be a nominal 500-Megawatt (MW) heliostat mirror and power tower thermal solar electrical generating facility comprised of two plants, HHSEGS 1 (250 MW), and HHSEGS 2 (250 MW). The direct emission of air toxics from solar power generation is minimal; however, the facility would start-up each day with input of energy from natural gas-fueled boilers associated with each plant. These boiler-related emissions would be the source of most of the non-solar emission from the facility. The other sources would include specific operational and maintenance activities necessary to operate and maintain the proposed facilities. These include diesel-fueled emergency generators and fire pumps, each power block's 249-MMBtu[5]/hr natural-gas-fired auxiliary boiler and 15 MMBtu/hr nighttime preservation boilers to maintain minimum system temperatures overnight, and small wet-surface air coolers. The auxiliary boiler would be used during the morning startup cycle to help the plant come up more quickly to operating temperature and to provide power to augment solar operation when solar energy diminishes from cloud cover. It is these sources that would be mostly responsible for most toxic exposures within HHSEGS.

Potential pollutants that could be emitted are listed in **Public Health Table 4** and include both criteria and non-criteria pollutants. These pollutants include certain volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs). Criteria pollutant emissions and impacts from such non-solar sources are examined in staff's **Air Quality** analysis. Since the facility would use dry cooling, there would be no emissions of toxic metals or volatile organic compounds from cooling tower mist or drift. Also, there would be no health risk from the potential presence of the Legionella bacterium responsible for Legionnaires' disease.

[5] Million British thermal units, stands for one million BTUs. BTU is a standard unit of measurement used to denote the amount of heat energy in fuels. A BTU is the amount of heat required to increase the temperature of a pint of water (which weighs exactly 16 ounces) by one degree Fahrenheit.

Public Health Table 4
The Main Pollutants Emitted from the Proposed Project

Criteria Pollutants	Non-criteria Pollutants
Carbon monoxide	Acetaldehyde
Oxides of nitrogen	Acrolein
Particulate matter	Ammonia
Oxides of sulfur	Benzene
Volatile Organic Compounds (VOCs)	1,3-Butadiene
	Ethylbenzene
	Formaldehyde
	Hexane
	Naphthalene
	PAHs (as BaP)
	Propylene
	Toluene
	Xylene
	Diesel Particulate Matter

Source: HHSG 2011a, Table 5.9-4 and Table 5.9-5

Tables 5.9-4, 5.1B-15R, 5.1B-16R and 5.1B-17R of the AFC (HHSG 2011a and CH2 2012p) list the specific non-criteria pollutants that may be emitted as combustion byproducts from HHSEGS boilers and its small wet surface air coolers (WSACs). The emission factors for these pollutants were obtained from the Ventura County Air Pollution Control District. **Public Health Table 5** lists each such pollutant and shows how it would contribute to the total risk obtained from the risk analysis. **Public Health Table 6** (modified from Table 5.9-5 of the AFC) lists the toxicity values used to quantify the cancer and noncancer health risks from the project's combustion-related pollutants. The listed toxicity values include RELs, used to calculate short-term and long-term noncancer health effects, and the cancer unit risks, used to calculate the lifetime risk of developing cancer, as published in the OEHHA's Guidelines (OEHHA 2003) and OEHHA / ARB Consolidation Table of OEHHA/ARB Approved Risk Assessment Health Values (ARB 2011).

Public Health Table 5
Types of Health Impacts and Exposure Routes Attributed to Toxic Emissions

Substance	Oral Cancer	Oral Noncancer	Inhalation Cancer	Noncancer (Chronic)	Noncancer (Acute)
Acetaldehyde			✔	✔	✔
Acrolein				✔	✔
Ammonia				✔	✔
Benzene			✔	✔	✔
1,3-Butadiene			✔	✔	
Ethylbenzene			✔	✔	
Formaldehyde			✔	✔	✔
Hexane				✔	
Napthalene		✔	✔	✔	
Polycyclic Aromatic Hydrocarbons (PAHs, as BaP)	✔		✔		
Propylene				✔	
Toluene				✔	✔
Xylene				✔	✔
Diesel Exhaust			✔	✔	

Source: OEHHA / ARB 2011 and HHSG 2011a, Table 5.9-5

Emission Levels

As previously noted, the health risk from exposure to each project-related pollutant is assessed using the "worst case" emission rates and impacts. Maximum hourly emissions are required to calculate acute (one-hour) noncancer health effects, while estimates of maximum emissions on an annual basis are required to calculate cancer and chronic (long-term) noncancer health effects.

The next step in the assessment process is to estimate ambient concentrations using a screening air dispersion model and assuming conditions that would result in maximum impacts. The applicant's screening analysis for the noted combustion byproducts was performed using the ARB/OEHHA Hotspots Analysis and Reporting Program (HARP). Ambient concentrations were used in conjunction with Reference Exposure Levels (RELs) and cancer unit risk factors to estimate the cancer and noncancer risks from operations. The applicable exposure pathways for the toxic emissions include inhalation, dermal (through the skin) absorption, soil ingestion, and mother's milk. This method of assessing health effects is consistent with OEHHA's Air Toxics Hot Spots Program Risk Assessment Guidelines (OEHHA 2003) referred to earlier.

Public Health Table 6
Toxicity Values Used to Characterize Health Risks

Toxic Air Contaminant	Inhalation Cancer Potency Factor $(mg/kg\text{-}d)^{-1}$	Chronic REL ($\mu g/m^3$)	Acute REL ($\mu g/m^3$)
Acetaldehyde	0.010	140	470 (1-hr) 300 (8-hr)
Acrolein	—	0.35	2.5 (1-hr) 0.7 (8-hr)
Ammonia	—	200	3,200
Benzene	0.10	60	1,300
1,3-Butadiene	0.60	20	—
Ethylbenzene	0.0087	2,000	—
Formaldehyde	0.021	9	55 (1-hr) 9 (8-hr)
Hexane	—	7,000	—
Napthalene	0.12	9.0	—
Polycyclic Aromatic Hydrocarbons (PAHs, as BaP)	3.9	—	—
Propylene	—	3000	—
Toluene	—	300	37,000
Xylene	—	700	22,000
Diesel Exhaust	1.1	5	-

Sources: ARB 2011 and HHSG 2011a, Table 5.9-5

The applicant's HRA was prepared using the latest version (1.4d) of the ARB's HARP model (ARB, 2009b), the ARB February 2011 health database (ARB, 2011), and the OEHHA Hot Spots Program Guidance Manual (OEHHA, 2003). Emissions of non-criteria pollutants from the project were analyzed using emission factors previously approved by ARB. Air dispersion modeling combined the emissions with site-specific terrain and meteorological conditions to analyze the mean short-term and long-term concentrations in air for use in the HRA. The EPA-recommended air dispersion model, AERMOD, was used along with 5 years (2006–2010) of compatible meteorological data from the Pahrump and Henderson, Nevada, meteorological stations. The meteorological data combined surface measurements made at Pahrump and Henderson with upper air data from Elko, Nevada. Because HARP was based on a previous EPA-approved air dispersion model, Industrial Source Complex Short Term, Version 3 (ISCST3), the HARP On-Ramp (ARB, 2009b) was used to integrate the air dispersion modeling output from the required air dispersion model, AERMOD, with the risk calculations in the HARP risk module.

Cancer Risk at the Point of Maximum Impact (PMI)

The applicant first presented the numerical cancer risk for the maximally exposed individual (MEI) which is the individual located at the point of maximum impact (PMI) as well as risks to the MEI at a residence (MEIR). Human health risks associated with emissions from the proposed and similar projects are unlikely to be higher at any other

location than at the PMI. Therefore, if there is no significant impact associated with concentrations at the PMI location, it is assumed that there would be insignificant impacts in any other location in the project area. The cancer risk to the MEI at the PMI is referred to as the Maximum Incremental Cancer Risk (MICR). However, the PMI (and thus the MICR) is not necessarily associated with actual exposure because in many cases, the PMI is in an uninhabited area. Therefore, the MICR is generally higher than the maximum residential cancer risk. MICR is based on 24 hours per day, 365 days per year, 70 year lifetime exposure.

Project-Related Impacts within Area Residences

The applicant-calculated cancer risk from maximal residential exposure was for a residence located approximately 1 mile west of the center of Hidden Hills Solar Plant 2, and approximately 300 feet west of the HHSEGS project boundary. Staff's specific interest in the risk to the maximally exposed individual (MEI) in a residential setting is because this risk most closely represents the maximum project-related lifetime cancer risk calculated from the present regulatory assumption of exposure 24 hours per day and 365 days a year over a 70-year lifetime.

Risk to Workers

Cancer risk to potentially exposed workers was presented by the applicant in terms of risk to the maximally exposed individual worker or MEIW. The applicant's assessment is for potential workplace risks, from exposure of shorter duration than for residential risks from 70 years of exposure. Workplace risk is presently assumed by the regulatory agencies to result from exposure lasting 8 hours per day, 245 days per year, over a 40-year period.

As described above, the inhalation cancer potency factors and RELs used to characterize health risks associated with modeled ambient concentrations are taken from the Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values (ARB, 2011) and are presented in **Public Health Table 6**. Health risks potentially associated with ambient concentrations of carcinogenic pollutants were calculated in terms of excess lifetime cancer risks. The total cancer risk at any specific location is found by summing the contributions from the individual carcinogens.

The applicant's screening health risk assessment for the project including emissions from all sources resulted in a maximum acute Hazard Index (HI) of 0.003 and a maximum chronic HI of 0.001 (CH2 2012p, Table 5.9-6R). As **Public Health Table 7** shows, both acute and chronic hazard indices are less than 1.0, indicating that no short- or long-term adverse health effects are expected. As shown in **Public Health Table 7**, total worst-case individual cancer risk was calculated by the applicant to be 2.8 in 1 million at the point of maximum impact (PMI).

Public Health Table 7
Operation Hazard/Risk at Point of Maximum Impact: Applicant Assessment

Type of Hazard/Risk	Hazard Index/Risk	Significance Level	Significant?
Acute Noncancer	0.003	1.0	No
Chronic Noncancer	0.001	1.0	No
Cancer Risk			
PMI[a]	2.8 in one million		No
MEIR[b]	0.5 in one million	10 in one million	No
MEIW[c]	0.4 in one million		No

[a] PMI = Point of Maximum Impact
[b] MEIR = MEI of residential receptors
[c] MEIW = MEI for workers
Source: CH2 2012p, Table 5.9-6R

To evaluate the applicant's analysis, staff used data from 2010 and conducted another analysis of cancer risks and acute and chronic hazards due to combustion-related emissions from the proposed HHSEGS project. The analysis was conducted for the general population, sensitive receptors, nearby residences, and the workers. The sensitive receptors, as previously noted, are subgroups that may be at greater risk from exposure to emitted pollutants, and include the very young, the elderly, and those with existing illnesses. Health risks were also evaluated at the nearest residence because population in the vicinity of a project could be seen as having a greater chance of long-term exposure to TACs at potentially significant levels. The nearest residence to the HHSEGS property boundary is approximately 300 feet west of the project boundary. The nearest residence to any power block equipment is approximately 3,500 feet south of the Solar Plant 2 power block and about 950 feet south of the project's southern boundary. The previously noted St. Therese Mission project, a commercial facility under construction, is approximately 0.5 mile southeast of the HHSEGS site. It is considered a potential sensitive receptor location because the facility would include a chapel, garden, restaurant, a visitor's center that will include a children's playground, and a care-taker residential unit.

The following is a summary of the most important elements of staff's heath risk assessment for HHSEGS:

- The analysis was conducted using the ARB/OEHHA Hotspots Analysis and Reporting Program (HARP), Version 1.4d.

- Emissions would be from the concurrent operation of all four natural-gas-fired boilers, three emergency diesel generators (one in the common facility area), and three diesel fire pump engines (one in the common facility area). Because evaporative drift emissions from the wet surface air coolers (WSACs) would be so low and potential impacts would be minimized through the use of high efficiency drift eliminators and deionized water with very low total dissolved solids (TDS) levels, these units were not included in the HRA.

- Exposure pathways included inhalation, dermal absorption, soil ingestion, and mother's milk.

- The local meteorological data, local topography, grid, residence and sensitive receptors, source elevations and site-specific and building-specific input parameters used in the HARP model were obtained from the AFC and modeling files provided by the applicant.
- The emission factors and toxicity values used in staff's analysis of cancer risk and hazard were obtained from the AFC and are listed in **Public Health Table 6**.
- Cancer risk was determined under the derived (OEHHA) risk assessment method.
- The following receptor locations were quantitatively evaluated in staff's analysis:
    - point of maximum impact (PMI), approximately 1 mile west of the center of Hidden Hills 2 (70-year residential scenario);
    - location of the nearest residence, also approximately 1 mile west of the center of Hidden Hills 2, approximately 300 feet west of the HHSEGS project boundary (70-year residential scenario);
    - St. Therese Mission, approximately 0.5 mile southeast of the HHSEGS site (70-year residential scenario); and,
    - Workers: occupational exposure patterns assuming exposure of 8 hours/day, 145 days/year for 40 years

Results of staff's analysis are summarized in **Public Health Table 8** and are compared to the results estimated by the applicant and presented in the AFC. The results estimated by staff and applicant are very similar, which verified the analysis of the applicant. It can also be seen from these results that the cancer and noncancer risks from HHSEGS operation would be significantly below their respective significance levels meaning that no health impacts would occur within all segments of the surrounding population. Since the project's combustion emissions of concern reflect the efficacy of the applicant's proposed emission controls, (use of natural gas as fuel and oxidative catalyst for emission minimization) staff recommends neither mitigation measures nor related conditions of certification.

As for potential impact in Nevada, the results show that the risks of receptors in California close to HHSEGS are lower than the significance level. Therefore, staff concludes that there won't be any impacts from HHSEGS on either California or Nevada.

Public Health Table 8
Results of Staff's and Applicant's Analyses for Cancer Risk and Chronic Hazard – HHSEGS Operations

	Staff's Analysis (by using data from 2010)			Applicant's Analysis		
Receptor Location	Cancer Risk[a] (per million)	Chronic HI[b]	Acute HI[b]	Cancer Risk[a] (per million)	Chronic HI[b]	Acute HI[b]
PMI	2.64	0.0013	0.0028	2.8	0.001	0.003
Nearest residence[c] MEIR	0.42	0.00031	0.0015	0.5	0.0002	0.002
Worker MEIW	0.4	-	-	0.4	-	-
St. Therese Mission	0.113	0.000059	-	-	-	-

[a] Significant level = 10 per million.
[b] HI = Hazard Index, Significant level = 1.
[c] Location of the nearest residence with a 70-year residential scenario.

CUMULATIVE IMPACTS AND MITIGATION

Within the 6-mile radius of the HHSEGS site, neither newly permitted sources nor other sources of toxic air pollutants are reasonably anticipated in the near future except for the St. Therese Mission project. Additional planned development projects that have not filed applications for air permits include the Pahrump Valley General Aviation Airport (approximately 10 miles away), the Element Power Solar Project (approximately 7 miles northeast of the proposed project), and the Sandy Valley Solar Project (approximately 5 miles east of the proposed project). Potential cumulative impacts of other development projects within 10 miles of the project site are discussed in Appendix 5.1G of the AFC. Since all related toxic emissions would be below significant thresholds and highly localized, staff does not expect their additive impacts to be significant, particularly in light of their distance from the project site.

As discussed above, the contribution of HHSEGS to both cancer risk and chronic and acute noncancer impacts would be very small even in a cumulative context including other regional sources; the estimates of cancer and noncancer risks from the project would be less than significant. Its contribution to area health impacts would thus be less than significant in a cumulative context.

COMPLIANCE WITH LORS

Staff has conducted a human health risk assessment for the proposed HHSEGS project and found no potentially significant adverse impacts for any receptors, including sensitive receptors. In arriving at this conclusion, staff notes that its analysis complies with all directives and guidelines from the Cal/EPA Office of Environmental Health Hazard Assessment and the California Air Resources Board. Staff's assessment is biased towards protection of public health and takes into account the most sensitive

individuals in the population. Using extremely conservative (health-protective) exposure and toxicity assumptions, staff's analysis demonstrates that members of the public potentially exposed to toxic air contaminant emissions of this project—including sensitive receptors such as the elderly, infants, and people with pre-existing medical conditions—will not experience any acute or chronic significant health risk or any significant cancer risk as a result of that exposure.

Additionally, staff has reviewed **Socioeconomics Figure 1**, which shows the environmental justice population is not greater than fifty percent within a six-mile buffer of the proposed HHSEGS and therefore, there would not be a disproportionate **Public Health** impact resulting from construction and operation of the proposed project to an environmental justice population.

Staff believes that it incorporated every conservative assumption called for by state and federal agencies responsible for establishing methods for analyzing public health impacts. The results of that analysis indicate that there would be no direct or cumulative significant public health and safety impact on any population in the area. Staff therefore concludes that construction and operation of the HHSEGS will be in compliance with all applicable LORS regarding long-term and short-term project impacts in the area of public health.

NOTEWORTHY PUBLIC BENEFITS

It is noteworthy that a solar electric generating facility such as the proposed HHSEGS project would emit significantly less TACs to the environment than most other energy sources available in California such as natural gas or biomass, thereby reducing the general public's health risks that would otherwise occur with these other energy sources. At the same time, the proposed HHSEGS would provide much needed electrical power to California residences and businesses, and contribute to electric reliability. Electrical power is not only necessary to maintain a functioning society, but it also benefits many individuals who rely on powered equipment for their health (such as dialysis equipment and temperature control equipment). For example, it is documented that during heat waves in which elevated air-conditioning use causes an electrical blackout, hospitalizations and deaths due to heat stroke are increased.

PUBLIC AND AGENCY COMMENTS ON THE PSA

Staff received some comments regarding soil stabilization chemicals, Valley Fever and health risk assessment. Please refer to **Appendix 1**, PSA Comment matrix – Public Health section, for details.

PROPOSED FINDINGS OF FACT

Based on the analysis, staff recommends the following findings:

- The HHSEGS project would be located in the Great Basin Valleys Air Basin (GBVAB) and within the Great Basin Unified Air Pollution Control District (GBUAPCD).
- During construction, no significant public health effects from diesel exhaust are

expected and no mitigation measures are necessary. Applicant should follow strict construction practices that incorporate safety and compliance with applicable LORS.

- During operation, the potential public health risks associated with operation of the HHSEGS would be insignificant. No significant adverse cancer, short-term or long-term health effects to any members of the public, including low income and minority populations, from project toxic emissions would be expected.
- Staff conducted an adequate analysis of the project's contributions to cumulative public health impacts. The TAC emissions contribution from the HHSEGS project would be relatively small regionally and locally, thus the overall impact of the project on regional and local public health would not be CEQA significant.
- Construction and operation of the HHSEGS would be in compliance with all applicable LORS regarding long-term and short-term project impacts in the area of public health.

CONCLUSIONS

Staff has analyzed the potential public health risks associated with construction and operation of the HHSEGS and does not expect any significant adverse cancer, short-term, or long-term health effects to any members of the public, including low income and minority populations, from project toxic emissions. Staff also concludes that its analysis of potential health impacts from the proposed HHSEGS uses a highly conservative methodology that accounts for impacts to the most sensitive individuals in a given population, including newborns and infants. According to the results of staff's health risk assessment, emissions from the HHSEGS would not contribute significantly or cumulatively to morbidity or mortality in any age or ethnic group residing in the project area.

MITIGATION MEASURES/PROPOSED CONDITIONS OF CERTIFICATION

No conditions are proposed.

ACRONYMS

AFC	Application for Certification
ARB	California Air Resources Board
ATC	Authority to Construct
Btu	British thermal unit
CAA	Clean Air Act (Federal)
CAL/EPA	California Environmental Protection Agency
CAPCOA	California Air Pollution Control Officers Association
CDC	Center for Disease Control and Prevention
CDPH	California Department of Public Health
CEC	California Energy Commission (or Energy Commission)
CEQA	California Environmental Quality Act
CO	Carbon Monoxide
CO_2	Carbon Dioxide
DPMs	Diesel Particulate Matters
FSA	Final Staff Assessment
GBUAPCD	Great Basin Unified Air Pollution Control District
GVAB	Great Valleys Air Basin
HAPs	Hazardous Air Pollutants
HARP	Hot Spots Reporting Program
HRA	Health Risk Assessment
HHSEGS	Hidden Hills Solar Electric Generating System (proposed project)
HI	Hazard Index
lbs	Pounds
LORS	Laws, Ordinances, Regulations and Standards
MACT	Maximum Achievable Control Technology
mg/m^3	milligrams per cubic meter
MMBtu	Million British thermal units
MW	Megawatts (1,000,000 Watts)
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NO_3	Nitrates
NOx	Oxides of Nitrogen *or* Nitrogen Oxides
O_2	Oxygen
O_3	Ozone

OEHHA	Office of Environmental Health Hazard Assessment
PAHs	Polycyclic Aromatic Hydrocarbons
PM	Particulate Matter
PM10	Particulate Matter less than 10 microns in diameter
PM2.5	Particulate Matter less than 2.5 microns in diameter
ppm	Parts Per Million
ppmv	Parts Per Million by Volume
ppmvd	Parts Per Million by Volume, Dry
PSA	Preliminary Staff Assessment (this document)
RELs	Reference Exposure Levels
SO_2	Sulfur Dioxide
SO_3	Sulfate
SOx	Oxides of Sulfur
SJVAB	San Joaquin Valley Air Basin
SRP	Scientific Review Panel
SRSG	Solar Receiver Steam Generator
TACs	Toxic Air Contaminants
TDS	Total Dissolved Solids
VOCs	Volatile Organic Compounds
WSACs	Wet Surface Air Coolers

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PUBLIC HEALTH

List of Comment Letters

		Public Health Comments?
1	Inyo County	
2	Bureau of Land Management	
3	National Park Service	
4	The Nature Conservancy	
5	Amargosa Conservancy	
6	Basin & Range Watch	
7	Pahrump Paiute Tribe	
8	Richard Arnold, Pahrump Piahute Tribe	
9	Big Pine Tribe of Owens Valley	
10	Intervenor Cindy MacDonald	X
11	Intervenor Center for Biological Diversity	
12	Intervenor, Old Spanish Trail Association	
13	Applicant, BrightSource Energy, Inc.	X

Comment #	DATE		COMMENT	RESPONSE
10	**July 21, 2012**		**Intervenor Cindy MacDonald**	
10.1	**p. 3-16 #6**		What are the public health implications (if any) if any of these considerations increase fugitive and windblown dust (PM10/PM2.5 particles) due to lack of site suitability (soils, road surface, aggregate, natural drainage) in terms of applying either of these two CARB pre-certified products?	Soil stabilizers are only one of a suite of mitigation measure used to control onsite fugitive and windblown dust, and will be used where effective and appropriate. Staff also recommends other mitigation measures and best practices, such as **AQ-SC3 (Construction Fugitive Dust Control)**, **AQ-SC4 (Dust Plume Response Requirement)** and **AQ-SC7 (Site Operation Dust Control Plan)**, for the purpose of minimizing all fugitive dust plumes and preventing them from leaving the project boundary. Preventing dust plumes from leaving the project boundary is a way to minimize concern for public health. Please note that dust plumes are transitory and temporary, depending on specific project activities under way, soil conditions, and meteorological conditions.
10.2	**p. 3-22 #3**		What mitigation measures does the CEC Staff recommend to protect public health during the construction and operational phases of the proposed project to insure air quality standards don't exceed significant thresholds of PM10/PM2.5 fugitive and windblown dust emissions for wind speeds occurring in the project area outside the currently undefined definition of "normal"?	The mitigation measures and best practices that address PM10/PM2.5 are included in **AQ-SC1** through **AQ-SC7** and **AQ-SC9** for construction and operation of the project. Please see the **Air Quality** section for details.

10.3	**p. 3-22 #4**		How will the CEC or the GBUAPCD monitor fugitive and windblown dust levels during the operational portion of the proposed project to detect levels and frequency of PM10/PM2.5 emissions exceeding significant thresholds and posing threats to public health?	The mitigation measures include **AQ-SC7** for operation of the project. Please see **Air Quality** section for details.
10.4	**p. 3-23 # 1**		Which regulatory agencies are CEC Staff referring to that recognize this is an appropriate mitigation measure the public can take to protect themselves from Valley Fever?	Staff used regulatory agencies to reflect the fact that the necessary exposure reduction measures are those specified by regulatory agencies such Center for Disease Control and Prevention (CDC) and California Department of Public Health (CDPH) as responsible for minimizing public exposure to dust and the causative agent of Valley Fever. To avoid confusion, in response to public comments staff has edited the **Public Health** section. Please see **Public Health** and **Worker Safety and Fire Protectio**n sections for details.
10.5	**p. 3-23 # 2**		Where have these regulatory agencies posted this policy and does it supersede laws aimed at protecting public health from known infections such as those produced by the fungus responsible for inducing Valley Fever?	Staff edited this section to indicate that these regulatory agencies such as CDC and CDPH recommend measures to reduce the risk of exposure to dust and the causative agent of Valley Fever. Please see **Public Health** section for details.
10.6	**p. 3-23 # 3**		How will tourists passing through and those visiting the area for recreational purposes protect themselves from air borne fungus resulting from project site disturbances as they have no place to go indoors?	As noted before, staff proposed some mitigation measures in the **Air Quality** section to keep any generated windblown dust within the project area to protect the workers and the public, including visitors. Also, based on the recommendations of CDC and CDPH, tourists and others can reduce their risk of getting valley fever by wearing N95 masks. Please note that dust plumes are transitory and temporary, depending on the specific project activities under way, soil conditions, and meteorological conditions.
10.7	**p. 3-23 # 4**		How will customers at the St. Theresa Mission and Front Site Training Institute protect themselves from exposure due to the proposed projects volume of site disturbance during both the construction and operational phase of the proposed project?	Based on the recommendations of CDC, the following measure can be taken to reduce the risk of getting valley fever: • They should stay inside or wear an N95 mask when a dust storm occurs. • The St. Theresa Mission and Front Site Training Institute can use HEPA filters in the heating, ventilation and air conditioning (HVAC) system to improve the indoor quality. • See **Public Health** section for general remedies recommended by CDC and CDPH.
10.8	**p. 3-23 # 5**		What is the feasibility of local residents and others in the area “staying indoors” during times when wind events last for longer than 1 day as is known to occur in the area?	Based on the recommendations of CDC, people venturing out of doors during a dust storm can wear a N95 mask or take prophylactic anti-fungal medication as noted in **Public Health** section. Please note that dust plumes are transitory and temporary, depending on the specific project activities under way, soil conditions, and meteorological conditions.

10.9	**p. 3-23 # 6**		How does the currently proposed mitigation measure of staying indoors during potential exposure times comply with Nuisance Regulation H&SC §41700?	In this specific case, the nuisance impact of concern is from exposure to the causative agent of valley fever through wind-blown dust. To avoid this nuisance, several mitigation measures in the Air Quality Section are implemented in the form of conditions of certification, including **AQ-SC3 (Construction Fugitive Dust Control)**, **AQ-SC4 (Dust Plume Response Requirement)** and **AQ-SC7 (Site Operation Dust Control Plan)**. These are intended to keep the dust plumes within the project boundary. Please note that dust plumes are transitory and temporary, depending on the specific project activities under way, soil conditions, and meteorological conditions.
10.1O	**p. 3-23 # 7**		Considering the proposed project site will experience continued soil disturbance over the project's lifetime due to critically required maintenance activities, is this the only mitigation plan that can be utilized to protect public health for the next 25-30 years if the project is approved?	In the **Air Quality** Section, staff also recommends some mitigation measures which would be implemented as required conditions of certification, including **AQ-SC3 (Construction Fugitive Dust Control)**, **AQ-SC4 (Dust Plume Response Requirement)** and **AQ-SC7 (Site Operation Dust Control Plan**). These are required for the purposes of minimizing dust plumes and preventing fugitive dust plumes from leaving the project boundary. Please note that dust plumes are transitory and temporary, depending on the specific project activities under way, soil conditions, and meteorological conditions.
10.11	**p. 3-29 #1**		What does this chart reflect and model besides cancer risks?	This chart addresses three categories of health impacts: (1) acute (short-term) health effects, (2) chronic (long-term) noncancer effects, and (3) cancer risk (also long-term). In cancer risk assessment, we use the criterion of 10 per million (10 x 10-6) as the significance criterion. If an incremental cancer risk is less than 10 in 1 million from a project, then the lifetime risk of getting cancer is less than significant and no mitigation measures are necessary. In noncancer risk assessment for both acute and chronic health effects, we use 1 as the significance criterion. If a hazard index is less than 1.0, it suggests that the worst-case exposure would be below safe levels and would thus be insignificant with regard to noncancer health effects. We assess these three health impacts for: (1) point of maximum impact (PMI), (2) residential receptors, and (3) workers. Furthermore, we assume that the person is exposed to these levels continuously for a 70-year period for PMI and residential receptors, while we assume exposure of 8 hours/day, 145 days/year for 40 years for workers.
10.12	**p. 3-29 #2**		What chemicals (by specific component) and emissions does this chart represent under "Acute Health Hazard Index" and "Chronic Health Hazard Index"?	According to Table 5.1-30R of the AFC (Summary of Toxic Air Contaminant Emissions from Project Operation), the toxic air contaminants emitted from the natural gas-fired boilers include Acetaldehyde, Acrolein, Benzene, Ethylbenzene, Formaldehyde, Hexane, Napthalene, Polycyclic Aromatics, Propylene, Toluene and Xylene. The toxic air contaminant emitted from emergency engines, fire pump engines and mirror cleaning vehicles and pump engines is Diesel Particulate Matter.
10.13	**p. 3-29 #3**		Does it incorporate just carcinogenic risks exclusively or does it incorporate other health risks such as respiratory conditions? If so, which ones?	Carcinogenic risks and non-carcinogenic risk are always calculated separately by using different assumptions, methodologies and criteria. Different toxic air contaminants may have various health effects. Please refer to **Public Health Table 5 (Types of Health Impacts and Exposure Routes Attributed to Toxic Emissions)** in staff's **Public Health** section for details.

10.14	**p. 3-30 #4**		Did the applicant model or provide any Health Risk of Diesel Exhaust assessment for potential respiratory impacts or other health impacts to workers or local populations resulting from diesel emissions besides cancer? If not, why not?	Yes. The applicant conducted a health risk assessment specifically for diesel exhaust from construction activities: the cancer risk is 7.41 in one million (below the significance level of 10) and the hazard index is 0.028 (well below the significance level of 1.0). The applicant also conducted a health risk assessment for all toxic air contaminants including diesel exhaust from operation activities.
10.15	**p. 3-30 #5**		Did the CEC Staff request any additional Health Screening Risks of Diesel Exhaust from the applicant besides the supplied cancer risk assessment or consult with the applicant in any way prior to the applicant initiating the parameters for the Health Screening Risk modeling? If not, why not?	No, staff did not request the applicant to conduct any additional screening, nor did staff consult with the applicant prior to the applicant conducting and submitting their analysis. Staff reviewed applicant's analysis and found it acceptable because it followed the ARB/CA OEHHA (2003) guidelines (Air Toxics Hot Spots Program Risk Assessment Guidelines, The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments) for health risk assessment and used appropriate assumptions (which require adjusting the 70-year lifetime exposure risk for an exposure period of 9 years). Staff also verified that the risk factors from The Scientific Review Panel (SRP) and non-cancer Reference Exposure Levels (RELs) from OEHHA/ARB (2011) are used appropriately by the applicant. Therefore, staff concluded that the applicant's analysis was appropriately conducted and therefore it was not necessary to request them to conduct any additional health risk assessment. Moreover, staff used data from 2010 and conducted our own, additional health risk assessment to evaluate health risks and compared our results to the applicant's analysis. Please refer to staff's **Public Health** section for details.
10.16	**p. 3-30 #6**		Where is the "produce ingestion pathway" referred to in the GBUAPCD's response or in the AFC files or subsequent documents?	A "produce ingestion pathway" refers to being exposed through consumption of locally grown plant foods. Toxic air contaminants may affect people directly if they inhale or ingest contaminated air, water, or soil. Exposure is also possible via secondary pathways such as a food chain. As a simplified example, TACs released from a boiler may settle onto a vegetable garden and become mixed into the soil. Plants such as fruits and vegetables growing there could absorb the TACs through their roots and into their edible portions. People who then eat the plants (or eat the animals that ate the plants) might then be exposed to the pollutant through ingestion. However, since only small amounts of TACs would be emitted from this project, and produce ingestion is an indirect pathway, staff believes the risk from this pathway is minimal, and it is reasonable to include only the following pathways in health risk assessment: inhalation, dermal (through the skin) absorption, soil ingestion, and mother's milk.
10.17	**p. 7-2 #6**		How does the CEC Staff determine potentially significant impacts, significant impacts and impacts that cannot be mitigated – including those that may affect public health and resources - if these project components have yet to be drawn, evaluated or assessed by qualified professionals in compliance with industry standards?	In cancer risk assessment, Energy Commission staff use 10 in 1 million as the significance criterion. If an incremental cancer risk is less than 10 in 1 million from a project, then the lifetime risk of getting cancer is less than significant and no mitigation measures are necessary. The 10 in 1 million risk level is also used by the Air Toxics "Hot Spots" (AB 2588) program as the public notification threshold for air toxic emissions from existing sources. In noncancer risk assessment for both acute and chronic health effects, Energy Commission staff use 1.0 as the significance criterion. If a hazard index is less than 1.0, it suggests that the worst-case exposure would be below safe levels and would thus be insignificant with regard to noncancer health effects. This assessment approach is consistent with those in the risk management guidelines of both California OEHHA and U.S. EPA. Please see '**METHOD AND THRESHOLD FOR DETERMINING SIGNIFICANCE**' in **Public Health** section for details.

10.18	**p. 14-18 #7**		If the applicant and/or CEC CPM approve the use of Pennz-Suppress D for dust suppression over the life of the project, what potential impacts will this product have to water, water quality and biological resources in and around the proposed project site?	Staff found that the soil stabilizers for dust control measures which would be used by the applicant are the ones pre-certified by the California Air Resources Board (ARB). One criterion to be eligible for pre-certification by ARB is that they would "not pose a significant hazard to public health and safety or the environment." (ARB Website http://www.arb.ca.gov/eqpr/midwestevalrpttxt.pdf) In other words, soil stabilizing materials used onsite must be non-toxic as required by Energy Commission requirements, by the ARB and by most Air Districts. Therefore, staff recommends use of soil stabilizers to control fugitive dust when necessary.
Comment #	**DATE**		**COMMENT**	**RESPONSE**
13	**July 23, 2012**	**Applicant -- BrightSource Energy, Inc.**		
13.1	**p. 228 Comments #1**			Staff corrected the error.
13.2	**p. 228 Comments #2**			Staff made some changes. Please see **Public Health** section for details.
13.3	**p. 229 Comments #3**			Staff made the change.
13.4	**p. 229 Comments #4**			Staff made the change.
13.5	**p. 229 Comments #5**			Staff made the change.
13.6	**p. 229 Comments #6**			Staff made the change.